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EXPERIMENTS ON ACTIVE STUDENT RESPONSE TO TELEVISED INSTRUCTION. STUDIES IN TELEVISED INSTRUCTION, INTERIM REPORT.

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EXPERIMENTS WERE DEVISED TO TEST THE EFFECTIVENESS OF TELEVISED INSTRUCTION. THESE WERE CONCERNED WITH WHETHER (1) METHODS OF LESSON PREPARATION AND TRYOUT COULD USE STUDENT RESPONSES TO REVISE AND IMPROVE A TELEVISION LESSON, (2) METHODS OF ELICITING ACTIVE STUDENT RESPONSE DURING INSTRUCTION COULD INCREASE THE EFFICIENCY OF LEARNING, AND (3) METHODS OF ENCOURAGING STUDENT FOLLOWUP ACTIVITY COULD STIMULATE ACTIVE INTEREST IN THE SUBJECT MATTER. SUPERIOR PERFORMANCE ON ACHIEVEMENT TESTS FOLLOWING THE REVISED TELEVISION LESSON INDICATED THAT STUDENT RESPONSES OBTAINED IN EMPIRICAL PRETESTING COULD LEAD TO IMPROVED INSTRUCTION. RESULTS ALSO INDICATED THAT, WHEN THERE WERE PROVISIONS FOR ACTIVE STUDENT RESPONSES COUPLED WITH APPROPRIATE SEQUENCING OF INSTRUCTION, THERE WERE TANGIBLE GAINS IN LEARNING EFFICIENCY. THE RESULTS OF THE EXPERIMENT ON STUDENT FOLLOWUP ACTIVITIES WERE NOT KNOWN WHEN THIS REPORT WAS SUBMITTED. RELATED REPORTS INCLUDING THE EXPERIMENTAL RESULTS, ARE ED 003 646 THROUGH ED 003 653. (PM)

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STUDIES IN TELEVISED INSTRUCTION

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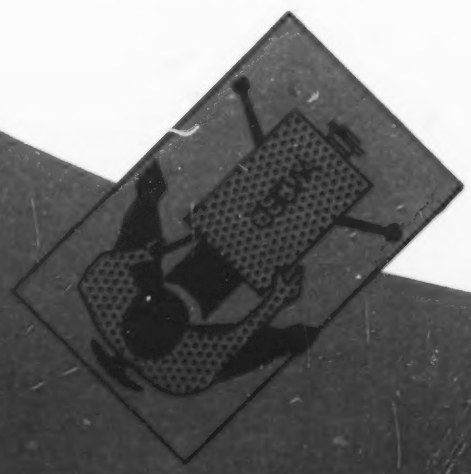
AN INTERIM REPORT



PITTSBURGH, PENNSYLVANIA

EXPERIMENTS ON ACTIVE STUDENT RESPONSE TO TELEVISED INSTRUCTION

Studies in Televised Instruction, Interim Report.

An ~~Interim Report~~

George L. Gropper and Arthur A. Lumsdaine

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INTRODUCTION

The ultimate role that televised instruction may play in American education will depend on the ability of educators and television producers to capitalize on television's unique advantages and at the same time to avoid its potential disadvantages. They must be able to take advantage of television's capacity to present visual demonstrations and to make the most far-reaching use of equipment, skills, and techniques economically unavailable to individual schools. At the same time, they must find ways of overcoming any tendency for the student to adopt an attitude of merely watching passively and being entertained by televised instruction.

The quality of the lesson shown on the air, the response of students to it during its presentation, and the kind of student follow-up activity it stimulates in the classroom or at home appear to be basic considerations for the most effective use of televised instruction. The premise underlying several related experiments within this study is that the effectiveness of well-produced television lessons will be materially increased by capitalizing on possibilities for more active student response. Some of these experiments have now been conducted; others are underway currently.

Based on potential advantages of learning-by-doing, several experiments have been designed to investigate ways for implementing learning-by-doing during a TV lesson. Other studies currently underway are investigating techniques for stimulating students to engage in follow-up learning activities after having seen a televised lesson. In a third set of experiments, student responses to a quiz -- given in conjunction with a preliminary try-out version of a TV lesson -- are utilized as a basis for improving the instruction before the presentation of the final version of the lesson.

This interim report describes progress to date in studies dealing with each of these three aspects of student response.

I. PRE-TESTING THE EFFECTIVENESS OF TELEVISED INSTRUCTION: UTILIZING STUDENT RESPONSE TO IMPROVE THE QUALITY OF TELEVISION LESSONS

Problem

A television instructor in presenting his lesson on the air "plays" to a live audience which he has no intention of teaching -- that is, the director, technicians, and other people in the TV studio. He can gauge their reactions, but he cannot gauge the reaction of the real audience, the students in the receiving classrooms.

During his presentation the TV instructor in the studio has no way of knowing whether students in classrooms comprehend the material he is presenting. He has no way of quizzing them, and, since he cannot observe student responses indicating which points are well understood and which are misunderstood, he has no way of deciding how to alter his presentation so that it will be better understood. Since these instructional advantages -- often available in classroom instruction -- are not open to him, the instructor loses an important advantage. In consequence, the quality and effectiveness of TV instruction may well be less then optimal.

One way to offset this disadvantage is to conduct a preliminary try-out of a lesson and to use data on student responses to a quiz, administered after presenting the try-out lesson, as a basis for revising it. This could offer an effective substitute for the give and take of the classroom, enabling the instructor to tailor his presentation to the needs of a particular group of students.

Method

Two lessons, one on "heat" and one on "chemistry" were prepared by two different TV instructors. These lessons were scheduled to appear as a part of a regular junior high school science series. Before being shown on the air to the entire population of classes that ordinarily watch the lessons, a preview showing of the "heat" and the "chemistry" lessons was transmitted (on a UHF channel during non-peak hours) to a few sample classes selected from this population. Following the program, students were given a quiz to determine which points in the lesson had been communicated effectively and which points had not.

As anticipated, on the basis of previous research (May and Lumsdaine, 1958; Zuckerman, 1954) item-by-item analysis of the test results indicated, that while certain points in the lesson "got across" so that they were fairly well understood, certain other points were much less well understood or even misconstrued.

The TV instructors were then briefed by the research staff on the weaknesses of the lesson as revealed by empirical data on specific points which students failed to understand. Possible improvements, including alternative demonstrations which might more effectively illustrate the principles they wished to teach, were also suggested to them.

In the lesson on heat, for example, a major point covered was the expansion of matter when heated. The TV demonstrator passed a metal ball through a ring and then heated it. (See Figure 1) The inability of the instructor to withdraw the ball after it was heated graphically illustrated the expansion of solids when heated. Quiz results showed that most students watching the preliminary version did, in fact, grasp the principle. No revision of this demonstration was judged necessary and none was made.

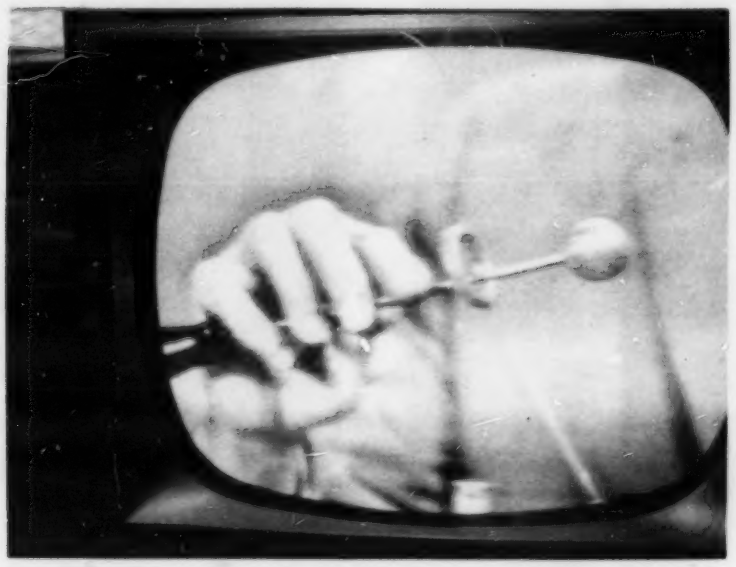

Figure 1

Less successful was the demonstration showing the effect of heat on a bi-metal bar. A bi-metal bar when heated bent due to the differing expansion coefficients of the two metals of which it was made. Acting as a thermostat, the bi-metal bar was made to ring a bell when heat caused it to bend. Quiz results showed that students watching the preliminary version misunderstood the relationship between the ringing bell and the properties of the bi-metal bar. (See Figure 2a) Part of the difficulty seemed to be that the rather slight degree of bending of the bar, before it made contact and rang the bell, was not clearly perceived by the students. Accordingly, in the revised version of the lesson the apparatus was changed so that the bending of the bi-metal bar (see Figure 2b) was more conspicuous to the students. The verbal commentary was also improved. Subsequent test results indicate that more students watching the revised program understood the demonstration and its underlying principle than did those students who watched the original program.

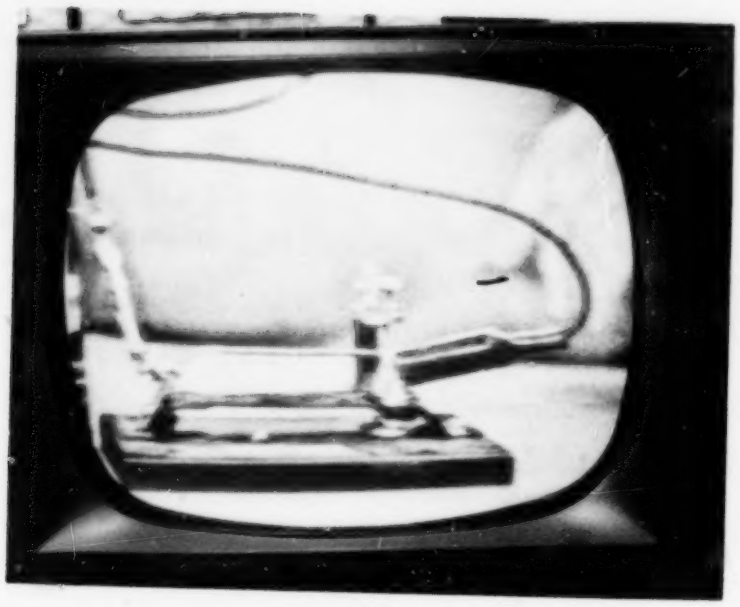

Figure 2a

Figure 2b

Preliminary Results

To test the improvement in effectiveness resulting from this try-out and revision procedure, the original and revised versions were telecast simultaneously to eight matched classes over WQED-WQEX, a unique two-channel educational facility in Western Pennsylvania. Classes were matched for IQ and for grade level. Following the simultaneous telecast, students were tested to assess their comprehension of principles as well as their knowledge of facts presented in the lesson.

Students who watched the revised lesson tended, in general, to acquire a better understanding of the concepts being presented. This was true for both the "heat" and the "chemistry" lessons. Students who watched the revised version of the heat lesson averaged 9.5 points higher (on a 90-point test) than those who watched the original. For the chemistry lesson, the students who watched the revised version averaged 12.9 points higher (on a similar test) than those who watched the original. Both differences were statistically significant ($P<.05$ level of confidence). Thus the lesson try-out and revision procedure brought about material improvements in students' understanding of the lessons.

Discussion

The results support the notion that student responses on achievement tests administered following a preliminary showing of a lesson may be used to provide useful feedback to the TV instructor. The information about students' responses enable him to make judgments that help him to adjust his presentation to the level of his audience. They thus provide a substitute for the "live" responses he would get in a classroom. Student test responses can inform him about common misconceptions and about misunderstood points. In addition, the data can inform him about points which got across well. The instructor then need only revise those points which students fail to understand.

The instructor can try-out his lesson live on TV, on film, or in a classroom. The necessary effort and expense, which can be pro-rated over a large number of classrooms, will be repaid in significantly improved student learning and understanding. The greater the number of classrooms the lessons serve, the greater will the return be. Educational television stations which provide direct and supplementary teaching for large numbers of classes, and which do so year after year, should find that the added expenses of pre-trial will be more than offset by the resulting gains in the effectiveness of their product.

II. STIMULATING ACTIVE STUDENT RESPONSE DURING TELEVISED INSTRUCTION: TECHNIQUES FOR INCREASING THE EFFICIENCY OF LEARNING

Problem

Active student response during instruction not only provides the instructor with feedback about the effectiveness of his material, it also enables the student himself to learn more efficiently. Research on instructional films (Hovland, Lumsdaine, & Sheffield, 1949; May and Lumsdaine, 1958) has indicated the potential importance of techniques for fostering active student response in bringing about more effective learning. Active anticipatory response to prompts or cues, presented verbally or visually, contributes to what is popularly known as learning-by-doing. Both theory and experimental data suggest that responding explicitly and correctly to specific, appropriate cues should foster more efficient learning.

Several separate experiments have been designed to test methods for increasing the extent to which useful student participation can be effected in response to a TV lesson. To date, field work has been completed on three experiments. The field work for several additional experiments will be completed in the next two months. One of the experiments, for which the field work and preliminary analysis of data has been completed, is described here. Other experiments will be reported subsequently.

Method

A 24-minute TV lesson comparing physical, chemical, and nuclear changes was prepared by a qualified science teacher. In preparing this standard, or "control", lesson he was instructed to cover material as set forth explicitly in a detailed statement of lesson objectives. Working from the same set of instructional objectives, a member of the research staff prepared an experimental presentation of the same type. The experimental version differed systematically from the control lesson in two main respects. First, it provided numerous occasions for students to make active, explicit responses as the lesson proceeded. Some of the responses were merely mental ones (i.e., being asked to think of the correct answer); others were overt (writing the correct answers on work sheets especially prepared for that purpose). A second difference was that the material in the experimental lesson was

sequenced in relation to the required responses. The sequencing was arranged so as to maximize the likelihood that the student would be able to respond correctly by assuring that all necessary prerequisites for understanding each point had been adequately covered.

To provide the opportunity for student response in the experimental version of the lesson, the lecturer paused at strategic places in the lesson to allow students time to complete a statement he had begun. They were instructed to think of the correct completion before he told them what it was. At other points in the lesson they were shown incomplete sentences on the screen. Their instructions, given both on the screen and in the classroom, were to fill in the missing word or words, on blanks that had been distributed to them, before the correct answer was flashed on the screen (see Figure 3). Instructions thus encouraged anticipation of correct answers as well as competition with the instructor. (Observers in the room uniformly reported that students did in fact anticipate answers, that is, they wrote them down before they were flashed on the screen.)

Preliminary Results

Six classes at the seventh and eighth grade levels were selected from the population of classes which regularly watch the science series. Children within each class, matched for intelligence, were randomly assigned to one of two rooms. One room received the experimental (or programmed) version of the lesson on a UHF channel, the other the control (or standard) version on a VHF channel. Both versions were telecast simultaneously.

Analyses of results from achievement tests administered to a sample class before the lesson on nuclear change went on the air revealed that students had relatively little prior knowledge about the subject matter to be taught. Following the program, a comparison of achievement-test data for equivalent groups of students who had watched the experimental and control versions of the prepared lesson revealed the superiority of the experimental version. That is, the students who watched the experimental version of the lesson scored significantly higher than students watching the control or standard version. This was true both on a test administered immediately and on a test administered after a delay of a week and a half.

1. Changes of state
are examples of p h _ _ _ _ _ _ _ c h _ _ _ _ .

2. When matter undergoes
physical change
molecules remain i n _ _ _ _ .

3. When ice melts
or water boils
nothing happens
to the H_2O _ _ _ _ _ _ _ _ .

NOW WATCH THE TV SCREEN

4. In chemical reactions
molecules break down into _ _ _ _ s .

5. Atoms recombine
in chemical reactions
to form new _ _ _ _ _ _ _ _ _ s .

6. The reaction that occurs
when atoms recombine
in new ways
is called a _ _ _ _ _ _ _ _ change.

NOW WATCH THE TV SCREEN

Figure 3

Discussion

A lesson that is (1) designed to elicit active response, and (2) sequenced to assure correct response at each point, appears to make a material improvement in learning. In this particular experiment, preliminary results indicate that such a lesson can surpass a standard form of lesson prepared by a skillful instructor experienced in television instruction. The relative importance of the contribution of the factor of sequencing and the contribution of active response is as yet undetermined.

In a further experiment, results of which have not yet been fully analyzed, active response was encouraged in an ordinary lesson without special effort to achieve optimal sequencing. Here the effect of active response alone will be analyzed. A series of additional experiments are planned to explore further the role of sequencing, of active response, and of optimal ways to elicit active response during televised instruction.

The research staff has already explored a number of ways of encouraging active response (but has not as yet analyzed results bearing on their effectiveness). To date, three techniques have been employed. In addition to giving students explicit instructions to make active responses, techniques utilized in the lessons have included: (a) pauses by the instructor in his lecture with, occasionally, a word or two of encouragement to think the correct answer; (b) pauses plus a question mark superimposed on the screen; and (c) incomplete sentences flashed on the screen plus work forms in the classroom with identical sentences and places to fill in the blanks. In further experiments, other ways to encourage active response will be tried out. It is the goal of these several related experiments to provide useful suggestions and recommendations that may enable other workers in educational television to achieve increased efficiency of learning through the encouraging of active student response during instruction.

III. PROMOTING STUDENT FOLLOW-UP ACTIVITY: TECHNIQUES FOR DEVELOPING INTEREST IN SUBJECT MATTER

Problem

Student activity following up a lesson not only enhances learning but also reflects interest in subject matter (Lumsdaine and Orr, 1959). It may also materially increase already existing interest. The purpose of an experiment to be conducted in this area is to develop and test certain procedures for encouraging voluntary follow-up activity that will afford further learning by direct experience outside the classroom.

Method

A "fun day" lesson has been prepared and recorded for presentation shortly during the science series. Six relatively easy experiments are shown which students can try at home.

The control version of this lesson features an adult lecturer explaining the principle behind each experiment and then demonstrating the phenomena explained. The experimental version uses student demonstrators with the lecturer's off-stage voice (he appears briefly in some segments) explaining the principles and describing the phenomena. It is hypothesized that students watching fellow students demonstrate experiments will be more effectively stimulated to engage in follow-up activity than will students watching the adult demonstrator.

An additional variable being investigated is that leaving an experiment incomplete might arouse more curiosity and increase the amount of subsequent student activity. It is hypothesized that experiments stopped in the middle will generate more interest than will completed experiments, and will lead more of the students to finish them to see how they turn out. Accordingly, only three of the experiments in the lesson were completed, three others being stopped in the middle.

Half of the students watching these programs will be provided with kits and instructions on how to perform the demonstrated experiments. The other half will receive no kits or instructions, but will be informed that they may write in for them. This will permit a check on the importance of providing the students with the "wherewithal" to carry out the suggested activity (as compared to the situation where students are required to take the initiative in obtaining the materials).

Status

This experiment has been designed and the lessons it will use have been recorded on film. It will be televised in late April, after which field observations will be made to obtain quantitative checks on the activity stimulated by the various experimental procedures.

IV. SUMMARY

This preliminary report has stressed the importance for TV instruction of: (a) methods of lesson preparation and try-out which can utilize student responses to revise and improve a TV lesson; (b) methods of eliciting active student response during instruction as a way to increase the efficiency of learning; and (c) methods of encouraging student follow-up activity as a way to stimulate active interest in the subject matter.

Preliminary results show that:

1. Use of student responses obtained in empirical pre-testing of lessons can lead to improved instruction, as indicated by superior performance on achievement tests following the revised lesson; and
2. Provision for active student response coupled with appropriate sequencing of instruction can yield tangible gains in learning efficiency.

Additional experiments are under way to study more analytically the role of active student response, and to assess additional techniques for stimulating student interest in learning subject matter. Final reports will describe all experiments in detail and, in addition, will make practical recommendations for use of techniques explored in this project.

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